REMARKS

Claims 1-19 are pending in the present application. Claims 1 and 17 are independent.

Claim Rejection – 35 U.S.C. 102

Claims 1, 17, and 19 have been rejected under 35 U.S.C. 102(b) as being anticipated by Kalb, Jr. (U.S. Patent 5,760,581). Applicants respectfully traverse this rejection.

Summary of the Present Invention

The present invention relates to a Hall device biasing circuit and an associated magnetism detection circuit, and in particular a circuit capable of having a large number of Hall devices. Previously known systems for driving a plurality of Hall devices were classified into two basic types. One type was a constant current driving system for supplying a constant current to drive the Hall devices. Another type was a constant voltage driving system for applying a constant voltage to drive the Hall devices. The constant current driving system (for example, as shown in Figure 8) can handle a large number of Hall devices, but is temperature dependent. The constant voltage driving system is not temperature dependent, but requires a driving current in proportion to the number of Hall devices. Thus, the constant voltage driving system has not been practical for a large number of Hall devices due to its potential significant increase in current consumption.

The present invention provides a Hall device biasing circuit based on the concept of the constant voltage driving system but wherein the Hall devices are connected in series, a characteristic in the constant current driving system. Connecting the Hall devices in series enables a fixed current consumption by the system by sharing the drive current between the devices (Specification, page 16, lines 9-13). Further, by supplying a constant bias voltage to each Hall device, the present invention is not temperature dependent, even though the Hall devices are connected in series (Specification, page 17, last paragraph). Still further, by biasing the drive current of each Hall device with the biasing circuit, the insufficiency and excessiveness in the driving currents for the Hall devices are counteracted (Specification, page 26, bottom paragraph).

Kalb, Jr.

Kalb, Jr. is directed to a circuit including daisy chain coupled triple drain magneto field effect transistors, AKA Hall device, for measuring magnetic filed. The coupling is such that sensitivity to magnetic flux is improved. In one embodiment (Figure 4), Gate 451 of triple drain 407 is biased to a voltage V + 2ΔV by being coupled to lateral drain 435, and gate 449 of triple drain 405 is biased to voltage of V + ΔV by being coupled to lateral drain 427. A center drain 425 is biased with a reference voltage V, and drains 433 and 441 are allowed to float to a voltage differential from V. Thus, reference voltage V leads to a bias voltage of V + ΔV to gate 449 of triple drain 405. Bias voltage of V + 2ΔV in turn is provided to gate 451 of triple drain 407. Such a daisy chain connection based on a flow path for the bias voltage enables the improved sensitivity.

Differenc s ver Kalb, Jr.

Claim 1 is directed to a Hall device biasing circuit comprising a plurality of terminals for applying a bias voltage to a plurality of Hall devices connected in series. Furthermore, claim 1 is directed to biasing a driving current of a Hall device, such that a driving current driving at least one Hall device is a current adjusted amount of a driving current driving another Hall device (see, for example, Figure 1 where the current I_2 biases the driving current of Hall device 2 supplied in the series connection). Applicants submit that Kalb, Jr. fails to teach or suggest the claimed elements of claim 1.

The Office Action alleges that Kalb's Figure 4 teaches the claimed invention. Applicants agree that Kalb, Jr. does appear to teach applying a bias voltage to a plurality of Hall devices. However, the Hall devices are arranged in a daisy chain. In particular, Kalb, Jr. is merely directed to daisy chain coupled triple drain magneto field effect transistors to accumulate voltage differentials generated in response to a magnetic field. In the daisy chain coupling, a driving current for one Hall device is a current from a single current source (Kalb, Jr, column 4, line 58, to column 5, line 52). Still further, the daisy chain coupling arrangement is such that each Hall device is permitted to float at the proper voltage potential "without current flowing between each of the devices" (Kalb, Jr. at column 5, lines 5-8). Thus, Applicants submit that Kalb, Jr. fails to teach or suggest at least biasing a driving current of a Hall device to supply a driving current to another Hall device, as recited in the present claimed invention.

Further with respect to claim 17, Applicants submit that Kalb, Jr. fails to teach or suggest the claimed "supplying a constant bias voltage to each of the plurality of Hall devices." The benefit of this feature is that it provides improved temperature dependency without increasing the driving current (Specification, page 11, lines 11-14). Rather, in Kalb, Jr. voltages to center drains 433 and 441 are permitted to float in order to enable the corresponding triple drain to operate at threshold (e.g., Kalb, Jr.: column 5, lines 32-36).

Thus, Applicants submit that each and every claimed element of claims 1, 17, and 19 are not taught or suggested by Kalb, Jr., and respectfully request that the rejection be withdrawn.

Claim Rejection – 35 U.S.C. 103

Claims 2-11, and 14 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Kalb, Jr. and Foster (U.S. Patent 4,833,406). Applicants respectfully traverse this rejection.

The Office Action admits that Kalb, Jr. does not disclose supplying a constant bias voltage to each of the terminals. The Office Action instead relies on Foster for teaching the missing constant voltage supply section. Foster does appear to teach a constant voltage driving system for a Hall device. Similar to the known system shown in Figure 7 of the present drawings, Foster's device is not temperature dependent (Foster: column 2, lines 48-55). Furthermore, Foster's device includes one voltage regulator for one Hall device. However, like Kalb, Jr., Foster's device also fails to teach a plurality of Hall devices connected in series in combination with a constant voltage supply section for supplying a

constant bias voltage to each of the plurality of Hall devices. In Foster's device, the Hall devices are connected in parallel. Thus, in either Kalb, Jr. or Foster the system would require a driving current in proportion to the number of Hall devices. Therefore, Foster fails to make up for the deficiencies in Kalb, Jr.

As mentioned above, the present claimed invention includes a plurality of Hall devices connected in series in a constant voltage type driving system. Having the series connected Hall devices enables operation at a constant current even over a large number of Hall devices. Neither Kalb, Jr. nor Foster address such a capability.

Accordingly, at least for this additional reason, Applicants submit that the rejection fails to establish *prima facie* obviousness for claims 2-11, and 14.

CONCLUSION

In view of the above amendments and remarks, reconsideration of the various rejections and allowance of claims 1-19 is respectfully requested.

Should the Examiner have any questions concerning this application, the Examiner is invited to contact Robert W. Downs (Reg. No. 48,222) at (703) 205-8000 in the Washington, D.C. area.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully Submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By: _____

Charles Gorenstein
Reg. No. 29,271
P.O. Box 747
Falls Church, VA 22040-0747
(703) 205-8000

CG/RWD/sjl

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

The claims have been amended as follows:

1. (Amended) A Hall device biasing circuit, comprising a plurality of terminals for applying a bias voltage to a plurality of Hall devices connected in series, respectively, so that a driving current driving at least one Hall device of the plurality of Hall devices is a current adjusted amount of a driving current driving another Hall device through a corresponding terminal of the plurality of terminals.

17. (Amended) A magnetism detection circuit, comprising:

a plurality of Hall devices connected in series;

and

a Hall device biasing circuit including at least a plurality of terminals corresponding to the plurality of Hall devices for supplying a constant bias voltage to each of the plurality of Hall devices respectively from the plurality of terminals so that a driving current driving at least one Hall device of the plurality of Hall devices is a current adjusted amount of a driving current driving another Hall device through a corresponding terminal of the plurality of terminals.